(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

10/553738

(43) International Publication Date
23 December 2004 (23.12.2004)

PCT

(10) International Publication Number
WO 2004/112384 A3

(51) International Patent Classification[7]: H04N 5/52

(21) International Application Number:
PCT/JP2004/008704

(22) International Filing Date: 15 June 2004 (15.06.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

| | | |
|---|---|---|
| 2003-170288 | 16 June 2003 (16.06.2003) | JP |
| 2003-416299 | 15 December 2003 (15.12.2003) | JP |
| 2004-131133 | 27 April 2004 (27.04.2004) | JP |

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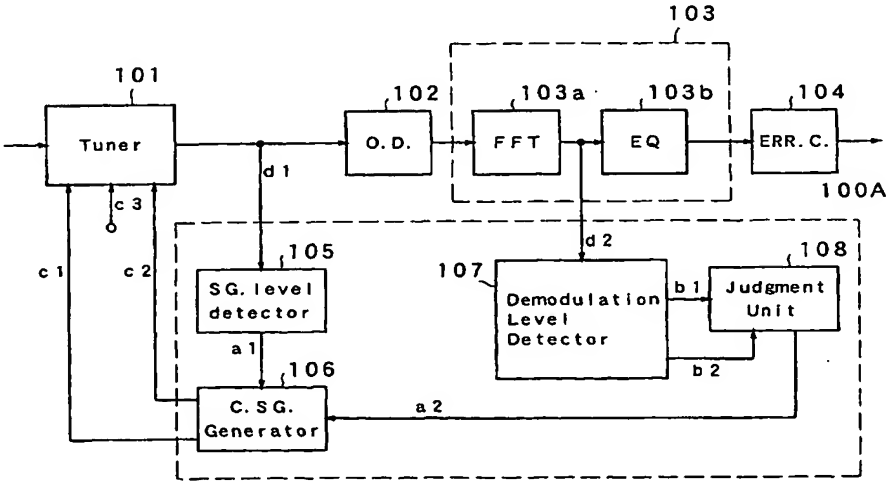
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

*[Continued on next page]*

(54) Title: DIGITAL BROADCAST RECEIVER




(57) Abstract: A tuner (101) has a dual AGC function, and frequency-converts an input signal into an IF signal. An orthogonal detector (102) calculates a complex signal from the IF signal. A demodulator (103) demodulates a digital signal from the complex signals. An error corrector (104) corrects the error of the digital signal. A signal level detector (105) calculates a level judgment signal from the IF signal. A demodulation level detector (107) detects a signal level of a demodulation signal on a desired band from an output signal of the demodulator. When a demodulation level judgment unit (108) generates a judgment signal representing an influence from interference waves in adjacent channel affecting on a signal on the desired band from the demodulation signal, a control signal generator (106) feeds back a gain control signal to the tuner in accordance with the judgment signal.

WO 2004/112384 A3

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

**(88) Date of publication of the international search report:**
2 June 2005

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

International Application No
PCT/J[redacted]4/008704

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N5/52

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N H03G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 5 999 559 A (TAKAKI)<br>7 December 1999 (1999-12-07) | 1,2 |
| Y | column 1, line 13 - line 24<br>column 5, line 26 - line 31<br>column 6, line 38 - column 8, line 4<br>figures 3,4,6 | 3-5 |
| X | GB 2 348 328 A (TOSHIBA)<br>27 September 2000 (2000-09-27)<br>cited in the application<br>figure 7 | 1,12-17,<br>20-23 |
| Y | page 48, line 5 - page 50, line 25 | 3-5 |

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 19 October 2004 | 04 04 2005 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,<br>Fax: (+31-70) 340-3016 | Berwitz, P |

Form PCT/ISA/210 (second sheet) (January 2004)

# INTERNATIONAL SEARCH REPORT

International Application No
PCT/J[redacted]4/008704

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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|---|---|---|
| X | EP 0 814 568 A (LUCENT TECHNOLOGIES)<br>29 December 1997 (1997-12-29)<br>page 3, line 34 - page 4, line 32<br>page 5, line 38 - line 50<br>page 6, line 14 - line 48<br>figure 1 | 1,2 |
| A | WO 01/06777 A (THOMSON LICENSING)<br>25 January 2001 (2001-01-25)<br>page 3, line 24 - page 5, line 3<br>page 6, line 3 - line 23 | 1 |
| A | US 2002/131533 A1 (KOIZUMI)<br>19 September 2002 (2002-09-19)<br>abstract; figure 15<br>page 1, paragraphs '0003! and '0004!<br>page 3, paragraph '0045!<br>page 4, paragraph '0066! - page 5, paragraph '0074!<br>page 10, paragraph '0135! - page 11, paragraph '0143! | 1 |
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| A | WO 99/56424 A (DAEWOO ELECTRONICS)<br>4 November 1999 (1999-11-04)<br>abstract; figure 1 | 2 |

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/008704

## Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-15,12-33

**Remark on Protest**

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-5,12-33

   Digital broadcast receiver. Determination of the AGC delay point

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2. claims: 6-8

   Digital broadcast receiver. Estimation of the strength of signals in adjacent channels

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3. claims: 9-11

   Digital broadcast receiver. Judgment of the contribution of distorsion signals to the carrier-to-noise ratio.

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Information on patent family members

International Application No
PCT/JP[redacted]4/008704

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| 2003-170288 | 16 June 2003 (16.06.2003) | JP |
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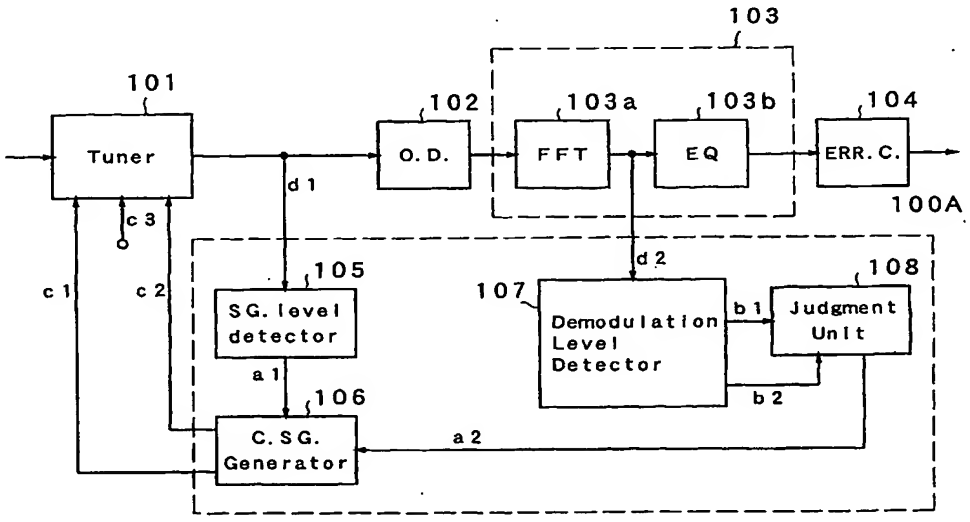
Published:
— *with international search report*

*[Continued on next page]*

(54) Title: DIGITAL BROADCAST RECEIVER




(57) Abstract: A tuner (101) has a dual AGC function, and frequency-converts an input signal into an IF signal. An orthogonal detector (102) calculates a complex signal from the IF signal. A demodulator (103) demodulates a digital signal from the complex signals. An error corrector (104) corrects the error of the digital signal. A signal level detector (105) calculates a level judgment signal from the IF signal. A demodulation level detector (107) detects a signal level of a demodulation signal on a desired band from an output signal of the demodulator. When a demodulation level judgment unit (108) generates a judgment signal representing an influence from interference waves in adjacent channel affecting on a signal on the desired band from the demodulation signal, a control signal generator (106) feeds back a gain control signal to the tuner in accordance with the judgment signal.

WO 2004/112384 A3

— *with amended claims*

**(88) Date of publication of the international search report:** 2 June 2005

**Date of publication of the amended claims:** 21 July 2005

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

AMENDED CLAIMS

[received by the International Bureau on 03 June 2005 (03.06.2005);
claims 12, 13, 16, 17, 20 and 21 amended; remaining claims unchanged (13 pages)]

said C/N judgment means compares the C/N information before a change of a delay point with the C/N information after the change of the delay point to judge the influence from the interference waves in adjacent channels affecting on the desired band when a point of switching between the gain control signal on the RF band and the gain control signal on the IF band in said tuner is set to be the delay point.

11. A digital broadcast receiver according to claim 10, wherein

said C/N detector compares the C/N information calculated in the C/N calculation means with fixed C/N information previously stored in a memory.

12. (amended) A digital broadcast receiver according to claim 1, wherein

said automatic gain controller includes:

a state monitor which detects the demodulation state from a demodulation output of said demodulator to generate a demodulation state signal;

a retainer which retains the demodulation state signal outputted from said state monitor for a certain period of time;

a comparator which compares the demodulation state signal outputted from said state monitor with the demodulation state

signal retained by said retainer to output a comparison signal representing a variation of the demodulation state after the elapse of a certain period of time;

a switch unit which determines a variation of a delay point on the basis of the comparison signal of said comparator and the demodulation state signal obtained by the state monitor so as to select a step width of small variation range when the demodulation state is good and a step width of large variation range when the demodulation state is poor, when a point of switching between the gain control signal on the RF band and the gain control signal on the IF band in said tuner is set to be the delay point;

a delay point determination unit which renews a value of the delay point from the variation of the delay point determined by said switch unit;

a signal level detector which detects the signal level of the reception signal from the IF signal of said tuner; and

a control signal generator which generates the gain control signal on the RF band and the gain control signal on the IF band from the delay point value of said delay point determination unit and the signal level of said signal level detector.

13. (amended) A digital broadcast receiver according to claim 12, wherein

said switch unit includes:

a reception state judgment block which judges a reception state from the demodulation state signal; and

a selection block which determines the variation of the delay point from the comparison result of said comparator and the judgment result of said reception state judgment block.

14. A digital broadcast receiver according to claim 12, wherein

the switch unit includes:

a reception state judgment block which judges a reception state from the demodulation state signal and the delay point value; and

a selection block which determines the variation of the delay point from the comparison result of said comparator and the judgment result of said reception state judgment block.

15. A digital broadcast receiver according to claim 13, wherein

the selection block selects and determines a specific variation of the delay point from a plurality of different delay point variations.

16. (amended) A digital broadcast receiver according to claim 15, wherein

the plurality of delay point variations selected in the selection block include at least one value significantly different from the other variations.

17. (amended) A digital broadcast receiver according to claim 1, wherein

said automatic gain controller includes:

a state monitor which detects the demodulation state from a demodulation output of the demodulator to generate a demodulation state signal;

a retainer which retains the demodulation state signal outputted from said state monitor for a certain period of time;

a comparator which compares the demodulation state signal outputted from said state monitor with the demodulation state signal retained by said retainer to output a comparison signal representing a temporal transition of the demodulation state;

a switch unit which determines a variation of a delay point on the basis of the comparison signal of said comparator and the demodulation state signal obtained in the state monitor when a point of switching between the gain control signal on the RF band and the gain control signal on the IF band in said tuner is set to be the delay point;

a delay point determination unit which renews a value of the delay point from the variation of the delay point

determined in said switch unit;

a timing controller which generates a timing control signal which is generated per a period which is several times of period when renewing a value of the delay point in said delay point determination unit;

an optimum delay point retainer which detects an optimum delay point within said period of time from the value of the delay point of said delay point determination unit, the demodulation state signal of said state monitor, and the timing control signal of said timing controller and outputs a value of the optimum delay point for following the changes of reception state;

a signal level detector which detects the signal level of the reception signal from the IF signal of said tuner; and

a control signal generator which generates the gain control signal on the RF band and the gain control signal on the IF band from the value of the optimum delay point retained by said optimum delay point retainer and the signal level of the reception signal of said signal level detector.

18. A digital broadcast receiver according to claim 17, wherein

said optimum delay point retainer stores and retains an optimum demodulation state within a time period of the control by said timing controller and the value of the optimum delay

point at that time.

19. A digital broadcast receiver according to claim 17, wherein

said optimum delay point retainer renews the value of the optimum delay point stored and retained per a time period of the control by said timing controller.

20. (amended) A digital broadcast receiver according to claim 17, wherein

said switch unit includes:

a reception state judgment block which judges a reception state from the demodulation state signal; and

a selection block which determines the variation of the delay point from the comparison result of the comparator and the judgment result of said reception state judgment block.

21. (amended) A digital broadcast receiver according to claim 17, wherein

the switch unit includes:

a reception state judgment block which judges a reception state from the demodulation state signal and the delay point value; and

a selection block which determines the variation of the delay point from the comparison result of said comparator and

the judgment result of said reception state judgment block.

22. A digital broadcast receiver according to claim 20, wherein

said selection block selects and determines a specific variation of the delay point from.

23. A digital broadcast receiver according to claim 22, wherein

the plurality of delay point variations selected in said selection block include at least one value significantly different from the other variations.

24. A digital broadcast receiver according to claim 1, wherein

said automatic gain controller includes:

a state monitor which detects the demodulation state from a demodulation output of said demodulator to generate a demodulation state signal;

a retainer which retains the demodulation state signal outputted from said state monitor for a certain period of time;

a comparator which compares the demodulation state signal outputted from said state monitor with the demodulation state signal retained in said retainer to output a comparison signal

representing a temporal transition of the demodulation state;

a synchronous state monitor which detects a synchronous state from the output of the demodulator to generate a control start flag;

a switch unit which determines a variation of a delay point on the basis of the comparison signal of said comparator, the demodulation state signal obtained in said state monitor, and the control start flag obtained in said synchronous state monitor when a point of switching between the gain control signal on the RF band and the gain control signal on the IF band in said tuner is set to be the delay point;

a delay point determination unit which renews a value of the delay point from the variation of the delay point determined in said switch unit;

a signal level detector which detects the signal level of the reception signal from the IF signal of said tuner; and

a control signal generator which generates the gain control signal on the RF band and the gain control signal on the IF band from the value of the delay point of said delay point determination unit and the signal level of said signal level detector.

25. A digital broadcast receiver according to claim 24, wherein

the switch unit includes:

a control counter which is reset in response to the control start flag obtained in said synchronous state monitor and executes a counting every time when the variation of the delay point outputted from said switch unit is renewed, thereby counting up a control number;

a state judgment block which judges a reception state from the demodulation state signal, the value of the delay point, and the control number; and

a selection block which determines the variation of the delay point from a comparison result of said comparator and a judgment result of said state judgment block.

26. A digital broadcast receiver according to claim 25, wherein

the selection block selects and determines a specific variation of the delay point from a plurality of different delay point variations.

27. A digital broadcast receiver according to claim 26 wherein

the plurality of delay point variations selected by said selection block include at least one value significantly different from the other variations.

28. A digital broadcast receiver according to claim 1,

wherein

the automatic gain controller includes:

a state monitor which detects the demodulation state from a demodulation output of the demodulator to generate a demodulation state signal;

a retainer which retains the demodulation state signal outputted from said state monitor for a certain period of time;

a comparator which compares the demodulation state signal outputted from said state monitor with the demodulation state signal retained in said retainer to output a comparison signal representing a temporal transition of the demodulation state;

a synchronous state monitor which detects a synchronous state from the output of said demodulator to generate a control start flag;

a switch unit which determines a variation of a delay point on the basis of the comparison signal of said comparator, the demodulation state signal obtained in said state monitor, and the control start flag obtained in said synchronous state monitor when a point of switching between the gain control signal on the RF band and the gain control signal on the IF band in said tuner is set to be the delay point;

a delay point determination unit which renews a value of the delay point from the variation of the delay point outputted from said switch unit;

a timing controller which generates a timing control signal for reviewing a value of the optimum delay point per certain period;

an optimum delay point retainer which detects an optimum delay point within a certain time period from the value of the delay point of said delay point determination unit, the demodulation state signal of said state monitor, and the timing control signal of said timing controller and outputs a value of the optimum delay point;

a signal level detector which detects the signal level of the reception signal from the IF signal of said tuner; and

a control signal generator which generates the gain control signal on the RF band and the gain control signal on the IF band from the value of the optimum delay point retained in said optimum delay point retainer and the signal level of said signal level detector.

29. A digital broadcast receiver according to claim 28 wherein

said optimum delay point retainer stores and retains an optimum demodulation state within a time period of control in said timing controller and a value of the optimum delay point at that time.

30. A digital broadcast receiver according to claim 28

wherein

said optimum delay point retainer renews the value of the optimum delay point stored and retained per time period of control of said timing controller.

31. A digital broadcast receiver according to claim 28 wherein

said switch unit includes:

a control counter which is reset in response to the control start flag obtained in the synchronous state monitor and executes a counting every time when the variation of the delay point outputted from said switch unit is renewed, thereby counting up a control number;

a reception state judgment block which judges a reception state from the demodulation state signal, the value of the delay point, and the control number; and

a selection block which determines the variation of the delay point from the comparison result of the comparator and the judgment result of the reception state judgment block.

32. A digital broadcast receiver according to claim 31 wherein

said selection block selects and determines a specific variation of the delay point from a plurality of different delay point variations.

33. A digital broadcast receiver according to claim 32, wherein

the plurality of delay point variations selected in said selection block include at least one value significantly different from the other variations.